THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

ETV

EPA
U.S. Environmental Protection Agency

ornl
Oak Ridge National Laboratory

ETV Joint Verification Statement

TECHNOLOGY TYPE:	**ENVIRONMENTAL DECISION SUPPORT SOFTWARE**
APPLICATION:	**INTEGRATION AND VISUALIZATION OF ENVIRONMENTAL DATA SETS**
TECHNOLOGY NAME:	**SitePro™ Version 3.0**
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The U.S. Environmental Protection Agency (EPA) has created the Environmental Technology Verification Program (ETV) to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by substantially accelerating the acceptance and use of improved and cost-effective technologies. ETV seeks to achieve this goal by providing high-quality, peer-reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations and stakeholder groups consisting of regulators, buyers, and vendor organizations, with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer-reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

The Site Characterization and Monitoring Technologies Pilot (SCMT), one of 12 technology areas under ETV, is administered by EPA's National Exposure Research Laboratory (NERL). With the support of the U.S. Department of Energy's (DOE's) Environmental Management program, NERL selected a team from Brookhaven National Laboratory (BNL) and Oak Ridge National Laboratory (ORNL) to perform the verification of environmental decision support software. This verification statement provides a summary of the test results of a demonstration of Environmental Software's SitePro™ environmental decision support software product.

DEMONSTRATION DESCRIPTION

In September 1998, the performance of five decision support software (DSS) products were evaluated at the New Mexico Engineering Research Institute, located in Albuquerque, New Mexico. In October 1998, a sixth DSS product was tested at BNL in Upton, New York. Each technology was independently

evaluated by comparing its analysis results with measured field data and, in some cases, known analytical solutions to the problem.

Depending on the software, each was assessed for its ability to evaluate one or more of the following endpoints of environmental contamination problems: visualization, sample optimization, and cost-benefit analysis. The capabilities of the DSS were evaluated in the following areas: (1) the effectiveness of integrating data and models to produce information that supports the decision, and (2) the information and approach used to support the analysis. Secondary evaluation objectives were to examine DSS for its reliability, resource requirements, range of applicability, and ease of operation. The verification study focused on the developers' analysis of multiple test problems with different levels of complexity. Each developer analyzed a minimum of three test problems. These test problems, generated mostly from actual environmental data from six real remediation sites, were identified as Sites A, B, D, N, S, and T. The use of real data challenged the software systems because of the variability in natural systems.

Environmental Software staff used SitePro Version 3.0 to perform the visualization endpoint using data from Sites D, S, and T. Sites D and S have groundwater contamination, and Site T has soil contamination. The intent of the SitePro analyses was to demonstrate the software's capability to integrate large quantities of data into a visual framework for assistance in understanding a site's contamination problem. Because SitePro was not developed to address sample optimization or cost-benefit problems, Environmental Software staff did not attempt to perform these aspects of the test problems.

During the demonstration SitePro was used to import data from many different sources (drawing and data files) and integrate these into the SitePro platform. Database manipulations (sort and query), GIS operations (multiple layers on maps, hot-linking of the data to the maps), data analysis (creating contours of water level and contaminant concentration, geologic boring maps, and geologic cross-section maps) and visualization (two-dimensional maps containing site features, contour levels, sample locations, and measured values) were demonstrated. Details of the demonstration, including an evaluation of the software's performance, may be found in the report entitled *Environmental Technology Verification Report: Environmental Software, SitePro™ Version 3.0,* EPA/600/R-99/093.

TECHNOLOGY DESCRIPTION
SitePro is a software application designed to help environmental professionals quickly and comprehensively characterize and manage information relevant to understanding environmental contamination problems. SitePro integrates a database, a geographic information system (GIS), computer-aided design (CAD), mapping, contouring, boring logs, cross-sections, graphing, imaging and reporting inside one application. This integration provides support for decisions pertaining to monitoring and remediation. SitePro can be used to manage various types of environmental data including data on contaminated soil and water, air emissions, wastewater, and health and safety parameters. The software allows environmental professionals to manage and share their site data using a single file. SitePro runs on Windows 95 and 98 and NT platforms.

VERIFICATION OF PERFORMANCE
The following performance characteristics of SitePro Version 3.0 were observed:

Decision Support: SitePro was able to quickly import electronic data on contaminant concentrations, geologic structure, and surface structure from a variety of sources and integrate this information on a single platform. SitePro was able to display the information in a visual context to support data interpretation.

Documentation of the SitePro Analysis: Environmental Software staff used SitePro to generate reports that provided an adequate explanation of the process and parameters used to analyze each problem. Documentation of data transfer, manipulations of the data (e.g., how to treat contamination data as a

function of depth in a well), and analyses were included. Model selection and parameters for contouring were also provided in the exportable documentation.

Comparison with Baseline Analysis and Data: SitePro was able to generate geologic boring maps and cross sections that accurately matched the data. The software was also able to generate hydraulic head measurement and contaminant concentration maps. The maps ranged from posting of data at the sample location to contours generated through inverse distance weighting (IDW) interpolation routines. In general, SitePro-generated contour maps were consistent with the measured data and baseline analysis. In a few cases, however, the SitePro predicted contours did not completely match the data. The cause for the poor agreement was the choice of contouring parameters used by the analyst.

Multiple Lines of Reasoning: Environmental Software chose not to use SitePro to provide multiple interpretations of the data with different modeling parameters. SitePro has several contouring algorithms, but only one contouring algorithm (IDW) was used in the demonstration. In addition, different parameters could have been used in the IDW algorithm to explore the data. Performing multiple interpolations of the data using different interpolation routines and parameters would have provided multiple views of the data that generally assist in data interpretation.

In addition to performance criteria, the following secondary criteria were evaluated:

Ease of Use: The demonstration showed that SitePro was extremely easy to use. The SitePro platform has a logical structure to permit use of the options in the software package. SitePro was demonstrated to import and export data in a wide range of formats. During the demonstration, one of four .dxf files provided by Environmental Software could not be read by other .dxf readers.

Efficiency and Range of Applicability: SitePro has a flexible database structure that supports multiple data input formats. This provided a flexible platform which addressed problems efficiently because the platform could be tailored to the problem under study. The database permits queries on a wide range of fields (e.g., chemical name, date, concentration, and well identifiers) and also permits filtering (e.g., include only the maximum concentration at a location over a range of sample dates). The software allows evaluation of a wide range of environmental conditions (e.g., contaminants in different media). Completion of three problems required one person-week of effort.

Operator Skill Base: To use SitePro efficiently, the operator should have a basic understanding of the use of computer software in analyzing environmental problems. This includes fundamental knowledge about GIS, CAD, and database files. In addition, skills in contouring environmental data is also key to achieving satisfactory results.

Training and Technical Support: SitePro requires minimal training for efficient use. An analyst with the prerequisite skill base can be using the software within a day. SitePro offers a wide range of options for training and technical support. A detailed on-line help system is supplied with the software package. In addition, a user's manual is available to assist in operation of the software. A step-by-step tutorial provided with the software package covers the major features. Two one-day training courses (introduction and advanced) are available if desired. Technical support is available for a yearly maintenance fee.

Cost: At the time of the demonstration, SitePro was priced at $2295 for a single license. Educational and multiple license discounts are available. In addition, new clients are required to subscribe to one year of technical support at $275 per year.

Overall Evaluation: The main strength of SitePro was its ability to easily integrate and manage information to allow analysis and spatial visualization of the data. SitePro was capable of managing data files from a wide range of sources, querying the data files to examine specific issues, and generating

boring logs, geologic cross-sections, and contour maps for hydraulic head and contamination. SitePro's capabilities and ease of use make it suitable for assisting with complex environmental contamination problems including multiple sources and contaminants. For an operator with the proper qualifications, the software is easy to use, so it is a good choice for users who do not operate the software on a regular basis. The main limitation of SitePro observed in the demonstration was that, in some instances, the contours generated by SitePro showed poor agreement with the actual data. However, the poor agreement was due to the analyst's choice of contouring parameters. Two minor limitations of SitePro that were noted in the demonstration were the poor legibility of the geologic cross-section and boring maps and the inability to read one SitePro file (in .dxf format) using other software programs.

The credibility of a computer analysis of environmental problems requires good data, reliable and appropriate software, adequate conceptualization of the site, and a technically defensible problem analysis. The results of the demonstration showed that the SitePro software can be used to generate reliable and useful analyses for evaluating environmental contamination problems. This is the component of a credible analysis that can be addressed by the software; other components such as proper conceptualization and use of the code depend on the analyst's skills. The results of a SitePro analysis can support decision-making. SitePro has been employed in a variety of environmental applications. Although the SitePro has been demonstrated to have the capability to produce reliable and useful analyses, improper use of the software can cause the results of the analysis to be misleading or inconsistent with the data. As with any complex environmental DSS product, the quality of the output is directly dependent on the skill of the operator.

As with any technology selection, the user must determine if this technology is appropriate for the application and the project data quality objectives. For more information on this and other verified technologies visit the ETV web site at http://www.epa.gov/etv.

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